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(Heidelberg)

SAN FRANCISCO

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ANEURYSM OF THE THORACIC AORTA.*

By ALBERT ABRAMS, A.M., M.D. (HEIDELBERG.)

SAN FRANCISCO.

SPONDYLOTHERAPEUTICS.—In the primitive era of hydrotherapy, the application to the spinal region of the hot waterbag and icebag was a conventional procedure dictated by empiricism with little or no physiologic knowledge concerning the action of hot and cold water on the spinal centers. Even at the present day our therapeutic armament includes the indiscriminate application of methods with neither rhyme nor reason. Thus therapeutics is discredited and the results are referred to suggestion; a portentous word, which signifies much or nothing, but usually the latter. The manipulation of definite vertebræ corresponds with the elicitation of definite reflexes, but if the vertebræ are promiscuously handled, counter reflexes are evoked which nullify the reflexes sought. Thus it is, that vertebral manipulation is equally influenced for weal or woe. Modern hydriatists have shown that hydrotherapeutic measures applied in definite regions will influence the viscera; in other words, there is a definite relationship between certain cutaneous and internal areas. The reason why local measures are often efficacious in visceral disease may be explained by

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Donaldson's theory; the splitting nerve-fiber sends one portion to the viscus and one to the skin overlying it. In 1834, the Griffin brothers of England, published a work in which 148 cases were analyzed showing the relation of certain symptoms to definite spinal regions. These symptoms were associated with spinal tenderness in fixed regions, and they concluded that the tenderness in question was either primary in the spinal cord or secondary to visceral or other diseases. Swedish gymnasts, notably Ling, noted among cardiopaths, tenderness over the fourth or fifth dorsal nerves when this region was subjected to friction.

The Swedish school recognizes definite areas of spinal tenderness identified with the different viscera. In 1841 Marshall Hall published his memorable work which established the importance of the spinal reflex. Brunton cited the fact that clinical experience demonstrated that blisters assuage acute inflammation by inducing contraction of the afferent vessels and thus diminishing tension in the vessels of the inflamed part. As a rule, the site of pain corresponds to the location of the lesion, but in other instances peripheral pains may be caused by diseases of the spinal cord. Reflex or transferred pains may cause an irritation at the origin of the nerve-trunk, and the pain may be referred to its peripheral distribution. The illustrations of Dana show the usual location of transferred pains. In 1893, Head demonstrated that in visceral disease, pain and disturbed sensation may be referred to definite cutaneous areas. Thus one may have a cutaneous expression of visceral disease, which I may call an endogenetic skin-reflex. According to Head, when a stimulus is applied to an organ or tissue with diminished sensibility and which is con-

nected centrally with an organ or tissue endowed with a higher degree of sensibility, the pain is referred to the relatively more sensitive part. Thus it is, that skin tenderness in visceral disease is caused by the passing of sensory impulses from a diseased organ to its corresponding spinal segment; in the latter disturbances are created so that additional impulses coming from the surface of the skin with which this is connected are so modified as to elicit abnormal or painful impressions which in consciousness are referred to the skin, which in the norm has a greater degree of sensitiveness. As a result of Head's investigations, definite cutaneous zones of hyperalgesia associated with visceral disease may be elicited by pressing with the head of a pin or pinching a fold of skin. I employ the vibrations of a tuning fork for the same object, and diminished sensibility (hypalgesia) is as frequently encountered as hyperalgesia. The zones of Head seem to explain the beneficial action of counter-irritation upon deep seated pains. Quincke has collected a number of sympathetic sensations associated with different diseases in which a cutaneous hyperalgesia is also found. Osteopathy ("discovered" in 1874), is founded on the theory that health signifies a natural flow of blood and that the bones may be employed as levers to relieve pressure on nerves, veins and arteries. Despite the contention of the osteopath, the latter in his manipulations of the spinal region unconsciously evokes reflexes which are cogent factors in the treatment of disease. The osteopath indignantly resents comparing his system with massage. Thus, in a representative work on this system by Hulett,[1] the latter contends that masseurs regard the tender spinal areas as secondary to visceral disease, whereas the osteopath conceives

them as primary and treats the central point. According to this reasoning, the osteopath regards disease from a central and not a peripheral standpoint. Dowse[9] affirms that ten minutes' work at the spine (by massage) will increase the volume of the pulse more than an hour's work at the body, as a whole, the spine being omitted.

The Vertebral Reflexes.—In medical literature the author has repeatedly referred to certain visceral reflexes evoked by cutaneous irritation; viz., the lung reflexes of dilatation[2] and contraction,[3] the heart reflex,[4] liver reflex,[5] stomach and intestinal reflexes[6] and the aortic reflexes,[7] which later will be the special subject for our discussion. The reflexes in question have more than physiologic interest, insomuch as the visceral reaction may be utilized in a diagnostic and therapeutic direction. The evidence heretofore adduced of the results achieved by electric, hydriatic, mechanic and the balneary treatment of disease, was naught else than a mere array of words conceived in conjecture only. Others less inclined to hypothesize sought an expeditious solution by referring their action to suggestion. The recognition of the visceral reflexes is more than an apologetic attempt to relegate the therapeutic methods in question to their proper sphere of action. If one doubts the existence of vertebral reflexes, let me direct your attention to a very simple expedient which I have only recently observed. While palpating, say the radial pulse, make firm pressure at the vertebral exit of the spinal nerves (preferably at the side of the upper dorsal vertebræ) and you will note a decided alteration in the character of the pulse, which often amounts to inhibition of the latter. Reference to Fig. 1 shows a number of central reflexes which may be elicited by concussing

definite vertebræ. The latter are bilateral. I cannot enter into a thorough discussion of this subject, but must refer you to my original contribution.[10] I may, however, demonstrate the biceps, triceps and wrist-jerk and the adductor reflex. The first combination of reflexes is obtained by concussion of the fifth and sixth cervical vertebras. To elicit this reflex the upper extremities must be placed in a

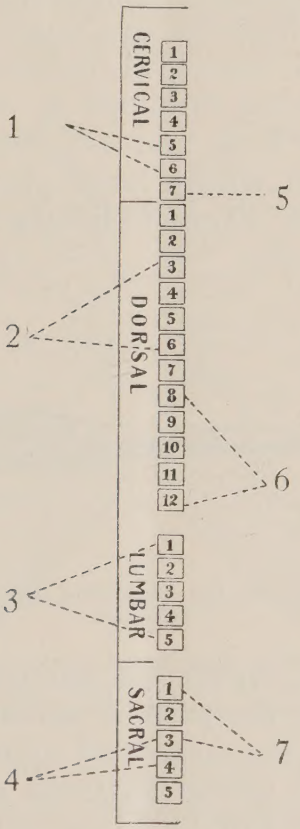

FIG. 1.—Vertebral concussional reflexes, showing the vertebræ to be concussed for their elicitation; 1, biceps and triceps reflexes and wrist-jerk; 2, pectoral and epigastric reflexes; 3, gluteal and adductor reflexes, cremasteric reflex from the 1st to the 3d lumbar vertebra; 4, plantar reflex; 5, aortic and cardiac reflexes of contraction (pressure at the vertebral nerve exits will inhibit heart); 6, aortic and cardiac reflex of dilatation; 7, gastric, intestinal, hepatic and splenic reflexes of contraction.

state of flexion, the elbows resting in either hand of an assistant: if the patient does not thoroughly relax the muscles while the spines in question are concussed, no reflexes will be elicited. Very often this reflex is better elicited if the patient allows his elbows to rest on a table with arms flexed and hands dropped so as to achieve thorough relaxation. To obtain the adductor reflex, the patient sits in a chair with legs extended and relaxed during the time any of the lumbar vertebras are concussed. To obtain the concussional vertebral reflexes for diagnostic purposes, the writer employs a strip of linoleum (about 6 inches long and 1½ inches wide) and a hammer (Fig. 2) with a large piece of thick rubber such as is used by French clinicians for eliciting the knee-jerk.

FIG. 2.—Rubber hammer for obtaining the concussional vertebral reflexes.

One may also strike the spinous processes indirectly by placing the palmar surfaces of the fingers in contact with the vertebral spines and, with the clinched fist, the dorsal surfaces of the fingers are struck a series of forcible blows after the same manner in using the hammer. The method with the hammer is preferred.

THE AORTIC REFLEXES.—The course of the upper surface of the normal aorta in the adult of middle life may be projected on the thorax by drawing a curved

line, beginning at a point corresponding to the right sternal line in the middle of the first intercostal space and ending at the point of insertion of the first left rib to the sternum. The highest point of the aortic arch is distant about 5 cm., and the beginning 2 cm. from the anterior thoracic wall, hence a forcible percussion blow (which is propagated to a depth of 5 cm.) cannot fail to elicit the dullness of the aortic arch if dilated. If the aorta is of normal size, dullness does not extend beyond the edge of the sternum on either side. Concussion of the four last dorsal

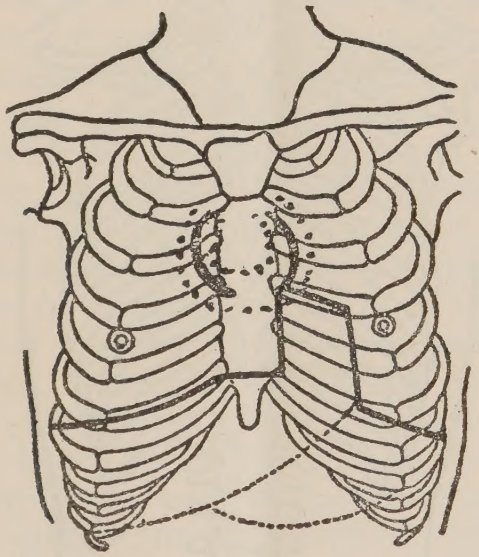

FIG. 3.—Aortic reflexes of contraction (dotted lines within continuous line) and dilatation (dotted lines without continuous line) in the patient of Dr. Sanderson with an aneurysm of the thoracic aorta.

vertebras (8th to the 12th dorsal vertebra) in succession by a series of sharp vigorous blows will in the norm dilate the thoracic aorta, which can be demonstrated by the *x*-rays and by percussion. Percussion must be executed at once after concussion of the vertebral spines, insomuch as the duration of the reflex of aortic dilatation is limited

(from one-half to one minute). Concussion of the spine of the seventh cervical vertebra causes a contraction of the thoracic aorta (aortic reflex of contraction). Thus it is, that when one provokes the dilatation reflex, the counter reflex of contraction dissipates at once the former reflex.

Postural Lung-Dullness.—The author has recently observed that posture influences lung-resonance. If one percusses the anterior chest in an individual first

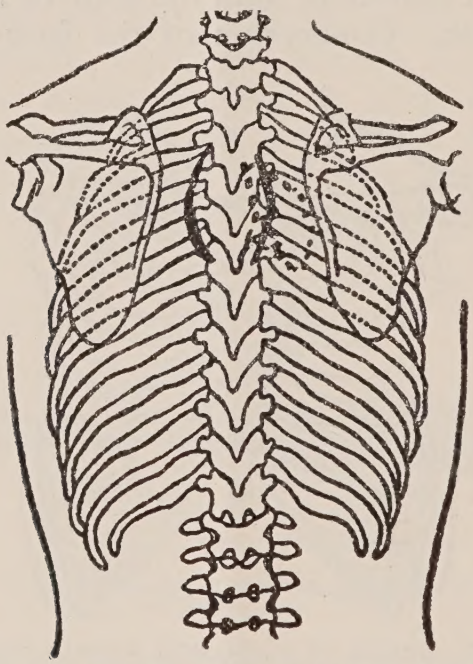

FIG. 4.—Posterior view of same patient (Fig. 3). Note that in this illustration only one part of the aneurysmal wall responds to the reflex of dilatation, a not infrequent phenomenon when aneurysms have attained some magnitude.

in the erect posture and then when the patient leans very far forward the resonance in the former posture is translated into dulness in the latter posture. Similarly, the lungs become dull when the patient leans backward or to the side. In other words, the writer believes that the pulmonary vessels being

unprovided with vasomotor nerves, permits of the gravitation of blood in the lungs in the direction of the posture of the patient, and that the dulness is due to an increased quantity of blood in a given area. The author further believes that many so-called cases of lung-atelectasis are in reality areas of lung congestion, and the differential diagnosis is as follows: In atelectasis, the area of dullness will disappear after repeated forced inspirations or by elicitation of the lung reflex (vigorous rubbing of the skin over the area); whereas in congestion (say the dullness is in the posterior portion of the thoracic region), the dullness will not completely disappear until the patient is placed in the prone posture. The author has noted furthermore, that when the patient leans far forward (so that the trunk is almost at right angles with the hips), the dullness over the upper anterior surface of the thorax corresponds with the dullness of the aortic arch elicited by the aortic reflex of dilatation.

The Aortic Reflexes in Diagnosis.—As before remarked, one is able to define by percussion the normal area of the arch of the aorta after concussion of the four lower dorsal vertebræ and a similar area of diminished resonance or dullness may be elicited when the patient leans far forward. Thus it is that, if the diminished resonance or dullness exceeds the norm, either the vessel is dilated or the site of an aneurysm. One may remark that if an aortitis is present, the reflex of dilatation will reproduce the symptoms peculiar to this affection, viz., pains in the upper sternal region extending through the mediastinum and to the shoulder and arm.

A dull area in the upper thoracic region or in the back (corresponding to the site of the aorta) if caused by a thoracic aneurysm, will show a dimin-

ished area of dullness when the spine of the seventh cervical vertebra is concussed (aortic reflex of contraction) and an increased area of dullness when the spines of the four lower dorsal vertebræ are successively concussed (aortic reflex of dilatation). Up to the present time of writing the author has examined 42 cases of aneurysm of the thoracic aorta and has noted an absence of the reflex in only two patients in whom the aneurysm had attained enormous dimensions. All these cases were controlled by skiascopic examinations. With the latter one may note a contraction and dilatation of the aneurysmal sac when the spines of the special vertebræ are concussed. One may also observe an immediate evanescence of pressure symptoms (dyspnea, cough, and pains) when the sac is brought to contraction after a single séance of vibration treatment applied to the spine of the seventh cervical vertebra.

The Aortic Reflex of Contraction in Treatment.—It occurred to the writer, when he first employed the aortic reflexes in diagnosis, that, if concussion of the seventh cervical vertebra would cause contraction of an aneurysmal sac, this fact would prove advantageous in the treatment of a thoracic aneurysm. The results achieved have exceeded the author's expectations. Only five patients with thoracic aneurysm have thus far been treated by the author according to his method, but they were all advanced cases. Absolutely no results were achieved in one case. This much may be said for this treatment that, unless the results are immediate, nothing can be expected from its continuance. The first case of aneurysm of the thoracic aorta thus treated was seen in consultation with Dr. Sanderson, a member of your association. The following record is presented:

Treatment was commenced July 7, 1905, on which date the patient complained of violent pains in the chest and dyspnea on the slightest exertion. On Aug. 2, 1905, the *x*-ray shadow of the aneurysm was denser, and the aortic reflexes could not be elicited. The latter I attributed to clot-formation in the aneurysmal sac, which inhibited whatever elasticity remained in the aortic walls. At this date aneurysmal pulsations could no longer be detected by the rays. Dulness formerly present over the sac on the anterior chest wall could no longer be elicited. Tracheal tugging was barely perceptible. The thoracic pains had disappeared and there was no longer any dyspnea on exertion. On the first of September, Dr. Sanderson stated that the only symptom which remained at the time the patient left for his home was slight tracheal tugging. In all my cases the latter symptom persisted despite the disappearance of subjective symptoms. I will not weary you with a recital of the histories of the other patients, but will content myself by presenting to you a patient of Dr. Rowell, a member of your association. About four years ago this patient first noted the appearance of the following signs: Cough, pressure in the chest, dyspnea, and a sensation of suffocation when he assumed the recumbent posture. Just before treatment was commenced the patient could not get more than three hours' sleep at night owing to paroxysmal attacks of coughing and choking. After the first treatment he could sleep the entire night, and to-day, after two weeks' treatment, consisting of daily séances (five minutes duration) by means of vibration applied to the seventh cervical vertebra, the patient is practically well and there is nothing to indicate the persistence of his original trouble beyond slight tracheal tugging.

During this brief period he has shown a gain of ten pounds in weight.* Now, a few words are necessary respecting the method of treatment. In the therapeutic elicitation of the vertebral reflexes, notably, the aortic reflexes, the vibratory apparatus which the physician must employ is the one giving the percussion stroke. All other motions, such as oscillations, shaking, and friction interfere with results; in other words, select an apparatus which percusses. First dust some talcum powder over the site of the spine of the seventh cervical vertebra to avoid irritation from friction of the pad connected with the apparatus; next cover the spine of the vertebra with several layers of lint which are attached to the skin by adhesive plaster. After this, the percussion stroke may be communicated directly to the spine of the seventh cervical vertebra, or indirectly, if the skin is sensitive by interposing a strip of linoleum. The daily séances, according to results, may last from five to fifteen minutes, but during the séance the treatment must be interrupted from time to time to avoid irritation of the skin. The latter may be avoided if the operator directs the patient to inform him the moment a burning sensation is experienced. Perhaps the best of all methods for eliciting the reflexes is the employment of a plexi-

*Since this address was delivered, three other cases of thoracic aneurysm were successfully treated by the same method. One of the patients referred to me by Dr. W. A. Clark of San Francisco with an enormous aneurysm was practically discharged after five weeks' treatment. The author has not the hardihood to regard his method as curative, for time alone is the decisive factor, yet a conservative estimate of the results prompt him to say that, as a palliative method, it surpasses any which has yet been introduced. The practical employment of the aortic and other reflexes will be embodied in a book on spinal therapeutics, which will be published shortly.

meter (a strip of linoleum) applied to the seventh spine, which is struck a series of rapid and moderate blows by means of a hammer, to the end of which is fixed a large piece of hard rubber (Fig. 2). By the latter method all the vertebral reflex are most surely evoked. It is wise in this method as well to protect the spinous process with a thick layer of lint.

Physiology of the Aortic Reflexes.—Claude Bernard's interesting observations advanced the clinical study of vasomotor phenomena. He found that when the sympathetics in the neck of a rabbit were cut, the blood-vessels in the ear on the corresponding side became dilated, and that if the peripheral ends were stimulated the ear became blanched. Those who are adepts in manual therapy find that manual pressure along the vertebral column will evoke either vasoconstriction or vasodilation; the former, by brief, and the latter by continuous pressure. It is evident that in explaining the genesis of the aortic reflex of contraction one is concerned with stimulation of the vasoconstrictor nerves, the centers of which are chiefly in the medulla, where they pass into the cord and emerge with the anterior roots as preganglionic sympathetic fibers. These fibers are not only capable of altering the caliber of the vessels, but by means of continuous stimuli passing over them they maintain the tone of the vessels.

The aortic reflex of dilatation is associated with stimulation of the vasodilator nerves, the reflex centers of which are located in the medulla and throughout the spinal cord. From the latter situation they emerge with the posterior spinal nerves. The author seeks to explain the aortic reflexes by either stimulation of definite vasoconstrictor and vasodilator nerves or their centers in the cord, and

he has established empirically that concussion of the seventh cervical vertebra stimulates the aortic constrictor nerves, whereas the dilator nerves are excited by concussion of the spines of the four lower dorsal vertebræ.

The Psychology of Clinical Observations.—When the author published his original communication on the subject of the aortic reflexes, he was the recipient of many letters, the burden of which represented the inability of the correspondents to confirm the observations of the author. It was impossible to answer all the communications at that time, and as this is an opportune moment, I will now endeavor to answer some of them. One of the most eminent physiologists in this country protested that, considering the pathologic condition of the walls of the aorta in aneurysm of that vessel, it could not in consequence be excited reflexly to alternate contraction and dilatation. Again, such clinical observations could not be accepted unless corroborated by physiologic investigations. No one can gainsay the fact that pulsation is an important sign of an aneurysm and, insomuch as this phenomenon is dependent on the elastic recoil of the walls, it follows that elasticity of the vessel is not annihilated in aneurysm of the vessel. It is true, as the author has frequently observed, that the walls of the aneurysm do not contract nor dilate equally in eliciting the aortic reflexes; in fact, there may be no perceptible change under the influence of the reflexes at one point, but a decided change at another point, although in practically every instance some perceptible change was observed. Theoretically at least, the aortic reflex will persist as long as the aneurysm pulsates. The clinician no longer regards the pronunciamento of the physiologist as apodictic.

We have learned to discredit many statements emanating from the laboratory investigator, not so much because the observations of the latter are faulty, but because there is a considerable difference between a laboratory and the bedside and a guinea pig and patient. Many of the facts derived from the laboratory suggest the comment of the mathematician, who, having demonstrated a new mathematical theory, thanked God that it could not be of the slightest utility to any living soul. Neither the pathologist nor the physiologist should forget that "pathology is the physiology of the sick." The presence of bronchodilator as well as bronchoconstrictor fibers in the vagus was conclusively established by the physiological investigations of Dixon and Brodie[14] in 1903, yet as A. G. Auld observes,[15] "It undoubtedly stands to the credit of Abrams to have proved, at least seven years since by a simple clinical observation,[16] that the vagus must contain bronchodilator as well as bronchoconstrictor fibers."

The final court of decree of the clinician is neither the physiological nor pathological laboratory. To test a given function one must compare it with a like function in individuals of the same species. Thus, if the same quantity of uric acid were excreted in a mammal as is excreted in a normal bird, it would have to be regarded as pathological. If disease were wholly a question of demonstrable lesions then the pathologist would be compelled to deny the existence of the so-called functional diseases. In consequence of this conflict between the laboratory and clinical investigator a hiatus has arisen which is now occupied by clinical pathology, a branch which endeavors to conciliate scientific and empirical medicine. Several years ago, the writer

observed that one could make a record of the pulsations of the head, and furthermore, that the cephalograms thus obtained in certain subjects were pathognomonic of cerebral arteriosclerosis. Investigating this subject further in the physiological laboratory of the University Hospital, London, and in Paris, the writer did not obtain the slightest clue to the cephalic pulsations, and he questions whether he is justified in rejecting a clinical observation which does not permit of physiologic demonstration in animals. One vituperator condemned my method of treating aneurysms as absurd, because it was not responsive to reason. My vituperator recalled the erudite German professor of economics who received a bed as a present. Until the small hours of the morning he busied himself with abstruse calculations to determine whether he was large enough for the bed, or if the latter were large enough for him. Finally, he was struck with the happy idea of getting into the bed, and to his intense delight discovered that it was admirably suited to his proportions. If my detractor were endowed with the true scientific spirit, he would not have condemned a new method of treatment without a trial, considering the kaleidoscopic changes constantly arising in all branches of science. The scientist rejoices one day at the birth of a new theory and officiates at its burial on the morrow. In 1903, in several issues of the London *Lancet*,[11] a discursive polemic was agitated on the subject of my "lung reflex." It was quite evident that one of the disputants did not rigorously execute the method for eliciting the reflex in question, but failed to cite this reason for condemning it, although others employed the reflex as a clinical sign of value.[12] Many new methods for a like reason have been relegated to oblivion. Some-

time ago, while in Paris, the writer found several clinicians who elicited the heart reflex[8] as a routine method of examination, and appeared quite content with the sign. The writer demonstrated that the sign as elicited was of no value, insomuch as when the precordial region was stimulated it likewise evoked the lung reflex, which also diminished the area of cardiac dullness, and that in consequence one could only rely on the deep area of cardiac dulness as an index of myocardial retraction. A prominent Eastern clinician spent several days at the author's office investigating visceral reflexes. One of the patients submitted had an aneurysm of the thoracic aorta. Here the aortic reflexes were the object of study. It was impossible to convince the clinician that there was any modification of the area of dulness after the elicitation of the reflexes, until the writer compelled him to close his eyes while percussing, when the results of percussion tallied. To the detriment of skillful percussion, instrumental has supplanted the finger-finger percussion. This is an egregious error, considering the fact that in percussion the adroit physician is guided not by what he hears as by what he feels. A word is permissible concerning percussion of the chest. When one percusses the normal chest, the sound is the product of the vibration of the lung tissue and the thoracic walls (notably the sternum, which is essentially a sounding board). It is the summation of this vibration which interferes with the elicitation of the dullness of the airless organs in juxtaposition to the lungs. If this vibration in question can be eliminated the definition of airless structures like the organs, tumors, aneurysms, etc., proves easy of attainment. This writer has referred to this method as vibrosuppression.[13] It is best achieved if per-

cussion is executed during the time the patient has suspended respiration after forced expiration and while the vibrations of the sternum are inhibited by firm pressure on the lower end of the bone by the hand of an assistant.

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